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Finally, since b is not negative, $e^{2kb} \neq 0$ and

$$b = \frac{1}{2k}.$$

Remark: If k were zero the last result would become $b = \infty$ which is consistent with the fact that equation (1) now represents rectilinear simple harmonic motion with infinite amplitude $a = b = \infty$.

II. Solution by Horace Olson, Chicago, Illinois.

From the conditions of the problem, $dv/dt = -cx \mp kv^2$, if the center of force is at $x = 0$. The upper or lower sign of kv^2 is taken according as the particle is moving in a positive or a negative direction.

From the identity $dv/dt = dv/dx \cdot dx/dt = v dv/dx$, we have $v dv/dx = -cx \mp kv^2$. Set $w = v^2$. Then $dw/dx = -2cx \mp 2kw$, a linear differential equation. Whence,

$$we^{\pm 2kx} = \mp \frac{cxe^{\pm 2kx}}{k} + \frac{ce^{\pm 2kx}}{2k^2} + C.$$

v, and, therefore, $w = 0$ when $x = a$ or b. Hence,

$$0 = \left(\frac{ac}{k} + \frac{c}{2k^2}\right)e^{-2ka} + C = \left(-\frac{bc}{k} + \frac{c}{2k^2}\right)e^{2kb} + C;$$

whence

$$(1 + 2ka)e^{-2ka} = (1 - 2kb)e^{2kb}.$$

When $a = +\infty$, the first member of this equation becomes 0 and $(1 - 2kb)e^{2kb} = 0$. Hence, if b is not $-\infty$, $2kb = 1$.

When $a = -\infty$, we have $-\infty = (1 - 2kb)e^{2kb}$; whence $b = +\infty$.

QUESTIONS AND DISCUSSIONS.

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NEW QUESTIONS.

32. In a discussion of the Peaucellier[1] Cell by analytic methods the following equations are obtained:

(1) $(x_2 - x_1)^2 + (y_2 - y_1)^2 - b^2 = 0$; (2) $(x_3 - x_1)^2 + (y_3 - y_1)^2 - b^2 = 0$;

(3) $(x_2 - X)^2 + (y_2 - Y)^2 - b^2 = 0$; (4) $(x_3 - X)^2 + (y_3 - Y)^2 - b^2 = 0$;

(5) $x_2^2 + y_2^2 - K^2 = 0$; (6) $x_3^2 + y_3^2 - K^2 = 0$;

(7) $x_1^2 + y_1^2 - 2cx_1 = 0$.

The result of eliminating x_1, y_1, x_2, y_2, x_3, y_3 gives an equation of the first degree, which establishes that the linkage will trace a straight line. There are various ways of effecting this elimination.

I. What element of the situation is left unused by the following procedure in the elimination?

(a) From equations (1), (3), (5) eliminate x_2 and y_2 and obtain an equation

(8) $$f_1(x_1, y_1) = 0.$$

(b) From equations (2), (4), (6) eliminate x_3 and y_3, and obtain an equation

(9) $$f_2(x_1, y_1) = 0.$$

(c) From equations (7), (8), (9) eliminate x_1 and y_1, and obtain the desired equation.

II. How should this procedure be supplemented to secure the result?

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[1] If reference is made to the article on "Linkages" in the December (1915) Monthly by Mr. Leavens, the following coördinates may be applied to his figure: $O(o, o)$; $C(c, o)$; $P_1(x_1, y_1)$; $M(x_2, y_2)$; $M_1(x_3, y_3)$; $P_2(XY)$.